As to their appearance above ground after a heavy rain, Darwin says:

I believe that they were already sick and their deaths were merely hastened by the ground being flooded.

Mr. Schneider and Dr. Kedzie say:

The writer has often noticed, in this connection, that on a lawn which is sprinkled the earth worms are very near the surface, in fact, if the ground is nearly saturated with moisture near its surface, the worms are partially above ground. This brings us to the theory advanced by Dr. Kedzie, of the Michigan Agricultural College, who says that, although the earth worms can live under water for some time, it is distasteful and that the worm will not stay under water when it can get out. Dr. Kedzie advances the idea that the ground being well soaked with water and the air thus expelled the earth worms leave their burrows and come out to breathe, crawling upon sidewalks or other objects where they can get the pure fresh air.

We hope that the proper consideration of this subject will remove one more popular error from the domain of metorology. The rains of frogs and of flesh and of blood belong to the same category. They may be phenomena of natural history but are not meteorological.

THIS YEAR'S CROP AND LAST YEAR'S GROWING SEASON.

It is natural to endeavor to trace the connection between the weather of any growing season and the resultant crop. Some years ago the Editor made a detailed study of the numerous conditions that effect the corn crop almost entirely outside of weather conditions. The conclusion was that the crop gathered from a field of corn depends so largely upon cultivation and skill in agriculture, it is so entirely an artificial product, that the influence of the weather as such is very largely obscured. It is only when a given yield per acre differs from the the normal by 25 per cent or more that we begin to get a clear insight into the influence of the weather.

The same principles apply to other crops, such as fruits, especially apples, pears, and peaches. In the October report of the Maryland and Delaware Section attention is called to the fact the orchardists of Missouri finding that the peach crop for 1899 would be a failure, soon began to cut back the trees and that this extensive pruning has brought about a splendid growth of new branches, with a prospect of a great crop in 1900. The plan of cutting back whenever early frosts have cut off a current crop is not particularly new. It has long since been applied to the vine, and in general is based upon the consideration that the best fruit comes from the youngest branches, and that if there is to be no fruit this year, then all the growing powers of the plant should be forced to bring forth fresh branches for next years crop. A tree or a vine is a storehouse whence the fruit draws its substance. If the crop fails in any given year a double amount of nutritious matter remains stored up in the body of the plant for use next year, so that if next year's season is favorable there will be an extra good crop, but if unfavorable, the storage process continues until the favorable season comes. It would be therefore quite misleading in many cases if we should attempt to define an exact relation between the weather and the crop of any particular growing season. We must study the past history of the plant for several seasons.

PROTECTION AGAINST FROST.

It has, we believe, been abundantly shown that in order to protect any extensive area of vegetation against injury by frost we must use a sufficient quantity of heat to keep the temperature above freezing for a few hours, or even days, while the danger is impending. It matters not whether the heat be used (1) to heat the air or the ground directly, or (2) to evaporate water and make a cloud of fog, or (3) to burn smudge and make a protecting cloud of smoke, or (4) whether the heat be utilized in the shape of work by engines spreading a layer of cloth or wooden slats over the field in order to shut in the heat of the soil and prevent its radiation to the clear sky, or (5) in the most interesting of all the physical processes—where water is used to moisten the soil and thereby passes from the condition of a compact mass of liquid into that of a thin capillary film surrounding every particle of soil over a large area, whereby a large quantity of latent heat is evolved; in all these, and doubtless other methods that might be mentioned, a certain adequate amount of heat must be utilized in order to counteract the tendency to freeze. The only question for the agriculturist is as to how he may accomplish his object most economically.

As regards the manner of making protective clouds of smoke or steam, or a mixture of both, several methods are given in Weather Bureau Bulletin No. 23, by Mr. W. H. Hammon, On Protection from Frost, but there are times when the simple direct heating of the air or the ground is also to be recommended as an economical process.

THE WEATHER AND THE DAIRY.

In a recent number of the report of the Virginia Section, Mr. E. A. Evans gave some results of his own observations on the effect of a fall in the temperature of the air, as causing a diminution in the yield of milk. He returns to this subject in the October report where he prints a further discussion from the Southern Planter. It appears that the practice of allowing cattle to stay in the fields or open pens all night during the winter months is productive of great loss to the farmers of the Southern States. * * * The food fed to the animals is first used in maintaining life and animal heat and only the surplus goes to the production of increased flesh or milk. The effect of a fall in temperature is to cut off this surplus. From records made at the Texas station during a norther, it was shown that the first effect of the cold was to increase the yield of butter, but the continued effect was to decrease both butter and milk by 20 per cent, and the cows did not recover for several days after the cold weather.

If cows are allowed to drink ice cold water, there is a fall of 6 or 8 per cent in the yield of milk as compared with those drinking warmer water.

LOSSES BY LIGHTNING.

The Iowa Monthly Review for October publishes an excellent article on losses by lightning in 1899, by Director J. Russell Sage, from which we quote the following as being of universal interest:

A notable feature of the crop season of 1899 was its unusual number of severe storms and excessive display of electric energy. This was an especial characteristic of the season from about the 1st of May to the middle of July, during which period more than three-fourths of the reported losses by lightning occurred. May was the stormiest month, the records showing that a measurable amount of rain fell at some station in the State during every day of the month. In June there was but one absolutely rainless day for the State at large, and nearly all the severe storms that occurred in these two months were accompanied by electric disturbances, resulting in more or less damage to farm property.

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The aggregate loss of property covered by these 395 reports is $52,524, of which sum $35,194 was the total loss estimated on buildings, and $17,330 on live stock.

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These reports give details of the loss of 581 farm animals from the direct effect of lightning, and this number does not include the 109 that were cremated in buildings fired by electric bolts. Of the live stock 9 were killed in barns that were struck and not fired; the others were in yards and fields.

And we are again confronted by the fact that wire fences are directly responsible for a very large percentage of the loss of live stock in the fields. The reports show that of the 581 farm animals killed by lightning, 395, or 68 per cent of the whole number were "electrocuted," while in close contact with wire fences.

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These are astounding figures, and vastly more effective and convincing than volumes of scientific theories relating to this matter. It appears that the stock growers of this State are paying a very heavy tax on their wire fences, in addition to the cost of construction. Or, possibly, these losses by lightning may not be considered a tax on that kind of fence, but rather a penalty for not constructing the fences properly, with necessary safeguards against such casualties. It is clear that some means should be devised to render wire fences less deadly, or, failing in that, they should be discarded altogether. It is believed that they may be rendered practically safe by the use of ground wires.

The fact may be noted that many of the storms of the past season have been accompanied by driving winds, with more or less hail, as well as an unusual amount of electric disturbance. During the prevalence of that class of storms farm animals in the fields seek closer companionship, and by the force of the storms are driven and crowded together in bunches or herds against the fences that obstruct their way. The reports show that many animals were killed in bunches by single strokes of lightning. * * * * * *

Nearly 30 per cent of the reports show that the strokes occurred on high and dry lands, somewhat distant from timber; and 20 per cent in or near groves or timber lots. This may signify merely that more stock is pastured on high and dry than on low, moist, or timbered lands; and also that buildings are generally erected on elevated and dry sites.

It appears to be certain that isolated trees in pastures are sources of danger to stock or persons that seek shelter under their branches, and it is probably true that dense groves or heavy timber afford a measure of protection against electric force, as well as the other elements of severe storms. The conclusion of the matter is that the safest retreat for man or beast during a thunderstorm is in a building protected by a well constructed rod or metallic roof. * * * *

I am convinced that a very large percentage of losses by lightning may be prevented, and the special purpose of our investigations should be to discover the means of prevention. An ounce of prevention is better than a pound of indemnity.

VAPOR PRESSURE FOR WATER AND ICE.

In comparing and liquefying ordinary air the atmospheric moisture makes much trouble for manufacturers, therefore the following extracts from recent correspondence may be of general interest:

My problem is to dry the air before cooling it for liquefaction by cold. The data which I can not find are those for saturation of air at high pressures and very low temperatures. The pressure in point is 1,500 pounds per square inch. What is the humidity of air at that pressure and from 60° F. down to 312° below zero Fahrenheit? At the lower temperature the pressure might not be over 300 pounds per square inch.

My idea is that the air which is taken into the machine perhaps unsaturated at the pressure and the temperature of the day soon becomes saturated by cooling, and the water vapor freezing is a source of trouble, clogging the pipes. The relation of the very high pressure employed to the relative humidity I am not so sure about, and on this I would like your opinion. Are there any tables for humidity and high pressures?

I am of the opinion that there is no way to remove the trouble but to dry the air chemically. Is air more easily dried at a low pressure, or at a high pressure?

The people using compressed air pass it through cold water, cooling it below the temperature at which it is to be used. When heated again for use it becomes unsaturated. But if it should be still further cooled instead of being heated, it would then deposit still more moisture, would it not?

The following is an extract from the reply:

The quantity of vapor, which a given space can contain, depends altogether on the temperature and only on the temperature. In your particular case we would say that the moisture per cubic foot of air at a pressure of 1,500 pounds per square inch could not be any greater than with same air at atmospheric pressure. Perhaps this broad statement needs a little qualification. Regnault measured the maximum vapor pressure in vacuo, that is, when no other gases were present, and he afterward measured this same pressure when ordinary air was present. According to some physical theories these two pressures should be the same. The very slight differences noticed in his results may plausibly be considered to be due to the slow diffusion of the vapor through the air and the difficulty of obtaining complete saturation under such circumstances. While this effect must exist in air undergoing compression, yet, we are satisfied that the statement made above may be regarded as substantially true, namely: That any given space, saturated with aqueous vapor, will contain the same amount, irrespective of any amount of air, that may be in that space at the same time. This is more particularly true, we think, in case of air subjected to compression, as the question of diffusion does not enter in the same way.

You are quite right in concluding that air undergoing compression soon becomes saturated, but not because it is cold, as a rule, but as a result of the compression itself. The air originally drawn in may not be saturated, but sooner or later, as the compression proceeds the moist vapor present is compressed to a pressure equal to the maximum pressure corresponding to the temperature at which it exists, and any further compression must cause condensation unless the temperature is increased. Of course, ordinarily, the temperature does increase, but the air is presently passed into some sort of cooling apparatus and then condensation takes place there.

In regard to drying the air artificially, the above statement indicates one way by which it can be done, viz, to cool it considerably after compression, thereby literally freezing out, so to speak, all the moisture it contains. The residual water vapor in air at a temperature of 60° below zero, for example, is almost inappreciable. In other words, such air is practically dry.

In regard to drying air chemically, I think it can be more completely dried at a low than at a high pressure. On this point I beg to refer you to the experiments made by Professor Morley, American Journal of Science (3), xxx, p. 140, and (3), xxxiv, p. 199.

Compressed air which has passed through water may be regarded as practically saturated with water vapor, and, as you say, if afterward cooled below the temperature of the water, it will deposit more moisture.

There are no tables treating of humidity at high pressures, because the ordinary tables answer the same purpose.

In addition to the previous remarks, the Editor submits the following small table, which is an abstract of the larger one published by Juhlin in the Proceedings of the Swedish Academy at Stockholm, and reprinted in the Meteorologische Zeitschrift for March, 1894, Vol. XI, p. 98. This table gives the elastic force, or the so-called tension of pure aqueous vapor in a space that is saturated at the respective temperatures. It will be seen that the pressures when liquid water is present in the inclosure are larger than when only particles of ice are present; therefore it is supposed that there are these two forms of aqueous vapor because the pressure of water is so appreciably different from the pressure in the presence of ice. The differences found by Juhlin agree almost exactly with those published by Professor Marvin in his report as contained in the Report of the Chief Signal Officer for 1891.

Temp.	Water vapor.	Ice vapor.	Temp.	Water vapor.	Ice vapor.	Temp.	Water vapor.	Ice vapor.	Temp.	Water vapor.	Ice vapor.
° C.	Mm.	Mm.	° C.	Mm.	Mm.	° C.	Mm.	Mm.	° C.	Mm.	Mm.
0	4.62	4.60	—13	1.74	1.53	—26	....	0.46	—39	....	0.13
— 1	4.30	4.25	—14	1.61	1.40	—27	....	0.42			
— 2	3.99	3.92	—15	1.49	1.28	—28	....	0.38	—40	....	0.12
— 3	3.71	3.62	—16	1.38	1.17	—29	....	0.34	—41	....	0.11
— 4	3.45	3.33	—17	1.28	1.06				—42	....	0.10
— 5	3.20	3.07	—18	1.18	0.97	—30	....	0.31	—43	....	0.09
— 6	2.97	2.82	—19	1.09	0.88	—31	....	0.28	—44	......	0.08
— 7	2.76	2.59				—32	....	0.26	—45	....	0.08
— 8	2.56	2.38	—20	1.00	0.81	—33	....	0.23	—46	....	0.07
— 9	2.37	2.18	—21	....	0.73	—34	....	0.21	—47	....	0.06
			—22	....	0.67	—35	....	0.19	—48	....	0.06
—10	2.20	2.00	—23	....	0.61	—36	....	0.18	—49	....	0.05
—11	2.08	1.83	—24	....	0.55	—37	....	0.16			
—12	1.88	1.67	—25	....	0.50	—38	....	0.15	—50	....	0.05

The excess of the vapor pressure for aqueous vapor over that for ice vapor attains its maximum, 0.214 mm. at the temperature of —15.5° C.

Of course if one wishes to dry the air before cooling it down to the point of liquefaction, one must have some independent method of doing it. If we already have at our disposal a quantity of liquefied air at a temperature of about —200° C. we may utilize this in order to dry any other mass of air. If any vessel containing air is immersed in a bath